

WHAT IS CLAIMED IS:

1 1. A catheter for removing material from a body lumen, said catheter
2 comprising:
3 a catheter body having a proximal end, a distal end, and an aperture;
4 a non-rotating cutting blade having a cutting edge configured to move
5 across the aperture between a capture position and a closed position which substantially
6 closes said aperture; and
7 an imaging device coupled to said cutting blade, wherein said imaging
8 device is in an imaging position when the blade is in the closed position and wherein the
9 imaging position is aligned with the location of the cutting edge when the blade is in the
10 capture configuration.

1 2. A catheter as in claim 1 wherein said imaging device comprises an
2 ultrasound transducer array.

1 3. A catheter as in claim 1 wherein said imaging device comprises at
2 least one optical fiber.

1 4. A catheter as in claim 1 wherein said imaging device comprises an
2 optical coherence tomography device.

1 5. A catheter as in claim 1 wherein said cutting blade is mounted on
2 said catheter body to extend outwardly from said aperture on the catheter body, and
3 wherein said cutting blade in said capture position is configured to leave a gap between
4 said cutting blade and said catheter body to define a cutting window in which material
5 may intrude to be engaged.

1 6. A catheter as in claim 5 wherein said imaging device is located on
2 a distal end of the cutting blade, said device capable of imaging material on the body
3 lumen when said cutting blade is in said capture position.

1 7. A catheter as in claim 5 wherein aperture on said catheter body
2 comprises a forward facing opening, said cutting blade mounted to extend linearly
3 outward from said forward-facing opening.

1 8. A catheter as in claim 5 wherein said imaging device remains
2 outside the catheter body when the blade is in the first open position and the second
3 closed position.

1 9. A catheter as in claim 1 wherein said cutting blade includes means
2 for defining said cutter window.

1 10. A catheter as in claim 1 wherein said material imaging device
2 comprises a hemispherical transducer mounted to provide a 360° image.

1 11. A catheter as in claim 1 wherein said cutting blade includes at least
2 one penetrating point.

1 12. A catheter as in claim 1 wherein said cutting blade comprises a first
2 aperture adapted to remove material that enters therein and a second aperture for exposing
3 said imaging device, wherein said cutting blade in a first position aligns said first aperture
4 with the aperture on the catheter body, and said cutting blade in a second position aligns
5 said second aperture with the cutter window.

1 13. A catheter for removing material from a body lumen, said catheter
2 comprising:
3 a catheter body having a proximal end, a distal end, and a cutter window;
4 a cutting blade mounted on said catheter body and configured to move
5 between a first open position and a second closed position which substantially closes said
6 cutter window; and
7 an imaging device mounted to extend outward from a forward facing distal
8 opening on said catheter body.

1 14. A catheter as in claim 13 further comprising a second material
2 imaging device on said cutting blade.

1 15. A catheter as in claim 13 further comprising a second material
2 imaging device on said catheter body, opposite said cutter window.

1 16. A method for removing material from a body lumen, the method
2 comprising:
3 positioning a catheter having a cutting blade with an imaging device
4 adjacent to said material in the body lumen, said cutting blade mounted on said catheter
5 body to excise material which enters an aperture defined at least in part by the catheter
6 body;
7 imaging said material on the body lumen with said material imaging
8 device when said cutting blade substantially closes said aperture;
9 opening said cutter window by moving said cutting blade to a first open
10 position; and
11 excising material by moving said cutting blade to a second closed position.

1 17. A method as in claim 16 wherein said imaging of material and
2 excising without repositioning of said catheter.

1 18. A method as in claim 16 further comprising imaging of a target
2 area on the body lumen after said material has been excised, said imaging occurring
3 without repositioning said catheter.

1 19. A kit comprising:
2 a catheter having a material imaging device mounted on a cutting blade
3 wherein said imaging device is in an imaging position when said cutting blade closes a
4 cutting window on the catheter;
5 instructions for use in removing material from a body lumen comprising
6 imaging said body lumen when said cutting window is closed; and
7 a package adapted to contain the device and the instructions for use.

1 20. A catheter for removing material from a body lumen, said catheter
2 comprising:
3 a catheter body having a proximal end, a distal end, and an aperture;
4 a slidable, telescoping portion on said catheter body configured to extend
5 outwardly from said aperture on the catheter body, said telescoping portion having a first
6 open position leaving a gap between one edge of said portion and said catheter body to
7 define a cutter window in which material may intrude to be engaged and having a second
8 closed position wherein said cutting blade is positioned to cut off said material.